REMARKS

By the present Amendment, claims 39-50 have been amended. No claims have been added or canceled. Accordingly, claims 39-50 remain pending in the application. Claims 39 and 45 are independent.

In the Office Action of December 1, 2006, claims 39-50 were rejected under 35 USC §103(a) as being unpatentable over Japanese Patent No. JP 9-17770 A to Fukuda in view of U.S. Patent No. 6,921,724 issued to Kamp et al. ("Kamp"). This rejection is respectfully traversed.

In rejecting the claims, the Office Action indicates that Fukuda discloses a plasma processing method for conducting a plurality of different types of processing on a film that is on a front side of a specimen placed on a mount surface of a specimen table disposed inside a processing chamber. The Office Action alleges that Fukuda discloses adjusting an internal temperature of the specimen table formed of a heat conduction member so that the temperature in a central portion of the specimen table becomes higher than the temperature in an outer circumferential portion thereof by a predetermined value. Plasma is generated by supplying a processing gas to the interior of the processing chamber in processing the film by applying a bias electrical power to the specimen table.

A heat conducting gas with a lower pressure is supplied to a space between the mount surface positioned above the central portion of the interior of the specimen table and a rear side of the specimen. A heat conducting gas with a higher pressure is supplied to a space between the mount surface positioned above the outer circumferential portion of the interior of the specimen table and the rear side of the specimen in order to adjust the heat conducting gas to a predetermined pressure difference in spaces of the central and outer circumferential portions of the rear side

of the specimen. The film is processed while adjusting the pressure difference to a value that is different from the predetermined pressure difference.

The Office Action admits that while Fukuda discloses a dual coolant system and a dual heat conducting gas system, they are described with respect to different embodiments. However, the Office Action indicates that one would have been motivated to combine the teachings of the different embodiments of Fukuda to provide finer control over the surface temperature of the wafer. The Office Action further admits that Fukuda does not expressly teach processing of the upper and lower films of a plurality of films on a surface with different temperature profiles obtained with the process settings of the claimed invention, or that the temperature settings can be adjusted based on information obtained before processing the specimen. Kamp is relied upon for teaching processing of the upper and lower films of a plurality of films on a specimen with different temperature profiles across the specimen, and adjusting the temperature settings based on information about the type of material in each film layer that is obtained before processing the specimen. Applicants respectfully disagree.

As amended, independent claim 39 defines a plasma processing method that comprises:

> locating a specimen on a specimen table provided inside of a processing chamber, wherein the specimen table comprises a central channel disposed in a central portion of a heat conductive block of the specimen table, an outer circumferential channel in an outer circumferential portion of the heat conductive block and a ring-like part suppressing a heat conduction between the central portion and the outer circumferential portion thereof disposed between the central channel and the outer circumferential channel inside the heat conductive block;
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> supplying a processing gas during evacuation of the inside of the processing chamber from a lower portion thereof;

generating plasma inside of the processing chamber to process a plurality of films stacked on the specimen;

circulating coolant inside each of the central channel and the circumferential channel, the temperature of the coolant in the central channel being adjusted to be higher than a temperature of the coolant in the circumferential channel;

supplying heat conductive gases to spaces between a rear surface of the specimen and a dielectric film comprising an upper surface of the specimen table, the spaces being constituted by independent spaces of a central space and an outer circumferential space by a ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block and contacts with the rear surface of the specimen, and adjusting a pressure of the heat conductive gas in the central space to be higher than that of the heat conductive gas in the outer circumferential space at a predetermined value of a pressure difference; and

after processing an upper film of the plurality of films on the specimen while maintaining the temperatures of the coolant and the pressures of the heat conductive gases, changing the value of the pressures of the heat conductive gases in the central space and the outer circumferential space, while the temperatures of the coolant is maintained, and processing a lower film of the plurality of films on the specimen.

According to at least one feature of independent claim 39, the specimen table comprises a central channel that is disposed in a central portion of a heat conductive block thereof, an outer circumferential channel in an outer circumferential portion of the heat conductive block, and a ring-like part disposed between the central channel and the outer circumferential channel inside the heat conductive block in order to suppress heat conduction between the central portion and the outer circumferential portion. Further, according to independent claim 39, heat conductive gases are supplied to the spaces between the specimen rear surface and a dielectric film that comprises an upper surface of the specimen table. The spaces where the heat conductive gases are supplied are independent spaces that consist of a central space and an outer circumferential space by virtue of the ring-like protrusion which is

disposed on the dielectric film at a position above the ring-like part inside the heat conductive block, and contacts the rear surface of the specimen. Further, the pressure of the heat conductive gas in the central space is adjusted so that it is higher than that of the heat conductive gas in the outer circumferential space by a predetermined pressure difference. Additionally, after the upper film of the plurality of films on the specimen has been processed, the temperatures of the coolant and the pressures of the conductive gases are maintained. Subsequently, the value of the pressures of the heat conductive gases are changed in the central space and the outer circumferential space while the temperature of the coolant is maintained. The lower film of the plurality of films on the specimen is then processed.

As discussed in the Background portion of the application, the density of reaction products above the wafer falls rapidly on the periphery of the wafer as a result of the influence of the density of reaction products formed within the processing chamber along the perimeter of the specimen table. Consequently, the amount of etching occurring on the perimeter of the wafer will differ from the amount of etching occurring in the center portion of the wafer. The present invention provides a temperature profile that is intended to equalize the amount of etching occurring along the entire surface of the wafer. This is accomplished, for example, by changing the temperature along the perimeter and center of the wafer so that the reaction products can be suitably distributed and adhered onto the surface of the wafer. This can be done by increasing the surface temperature of the wafer in the portion where the density of reaction products is high and reducing the temperature where the density of reaction products is low. According to independent claim 39, the space on the surface of the specimen table is divided into two portions by the ring-like protrusion. When the pressure of the heat transfer gases supplied to the

two spaces are changed, the change in pressure in one space does not effect the pressure in the other space.

The Office Action alleges that Fukuda discloses most of the features of the claimed invention. This does not appear to be the case. Fukuda provides an arrangement wherein a temperature controlled gas, supplied to the central domain (31) and the periphery domain (32) inside the electrostatic chuck (30), is emitted into a small space between the wafer and the specimen table via orifices (31a) and (32a). The temperature controlled gas flows toward the perimeter side of the surface of the electrostatic chuck, and then flows out of the perimeter and into a chamber (3). See paragraph 35. Although Fukuda provides a plurality of orifices on the surface of the electrostatic chuck, the temperature controlled gas flows toward the perimeter of the wafer as indicated by arrow K.

While Fukuda discloses the inside of the electrostatic chuck being divided into different areas, there does not appear to be any disclosure or suggestion for dividing the center and peripheral side of the space between the surface of the wafer holding stage and the wafer. Importantly, the arrangement of Fukuda could not accommodate a ring-shaped protrusion as recited in the claimed invention. The electrostatic chuck of Fukuda also includes porosity ceramics, a pair of ceramic blocks corresponding to the central domain and the periphery domain, and a barrier. The arrangement of Fukuda appears to prevent the temperature controlled gases from being mixed with each other, but does not address any heat exchange (or thermal insulation) between the gases. See paragraph 36. Accordingly, even if the temperature controlled gasses are separated from each other, they are still able to exchange heat with each other.

Kamp discloses an etch processor for etching a wafer that includes a chuck and a temperature sensor for monitoring the temperature of the wafer. The chuck is provided with a heater controlled by a temperature control system in order to maintain the temperature of the chuck at a selectable set point. According to Kamp, the wafer is placed on the chuck and set to a first set point temperature and processed. The wafer can subsequently be set to a second set point temperature and exposed to further processing. See Abstract. Kamp is completely silent on providing a ring-shaped member to divide the space where the heat transfer gas is supplied to the upper surface of the electrostatic chuck. This is further apparent since the heater is inside the electrostatic chuck which is formed from a dielectric material. The manner in which the temperature profile is generated in Kamp (e.g., using the heater embedded in the electrostatic chuck) differs completely from that of the claimed invention.

The cited references simply fail to provide any disclosure or suggestion for features recited in independent claim 39, such as:

> locating a specimen on a specimen table provided inside of a processing chamber, wherein the specimen table comprises a central channel disposed in a central portion of a heat conductive block of the specimen table, an outer circumferential channel in an outer circumferential portion of the heat conductive block and a ring-like part suppressing a heat conduction between the central portion and the outer circumferential portion thereof disposed between the central channel and the outer circumferential channel inside the heat conductive block;
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> supplying heat conductive gases to spaces between a rear surface of the specimen and a dielectric film comprising an upper surface of the specimen table, the spaces being constituted by independent spaces of a central space and an outer circumferential space by a ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block

and contacts with the rear surface of the specimen, and adjusting a pressure of the heat conductive gas in the central space to be higher than that of the heat conductive gas in the outer circumferential space at a predetermined value of a pressure difference; and

after processing an upper film of the plurality of films on the specimen while maintaining the temperatures of the coolant and the pressures of the heat conductive gases, changing the value of the pressures of the heat conductive gases in the central space and the outer circumferential space, while the temperatures of the coolant is maintained, and processing a lower film of the plurality of films on the specimen.

It is therefore respectfully submitted that independent claim 39 is allowable over the art of record.

Claims 40-44 depend from independent claim 39, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 39. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

Independent claim 45 defines a plasma processing method that comprises the steps of:

locating a specimen on a specimen table provided inside of a processing chamber, wherein the specimen table comprises a central channel disposed in a central portion of a heat conductive block of the specimen table, an outer circumferential channel in an outer circumferential portion of the heat conductive block and a ring-like part suppressing a heat conduction between the central portion and the outer circumferential portion thereof disposed between the central channel and the outer circumferential channel inside the heat conductive block;

supplying a processing gas during evacuation of the inside of the processing chamber from a lower portion thereof;

generating plasma inside of the processing chamber to process a plurality of films stacked on the specimen;

circulating coolant inside each of the central channel and the outer circumferential channel, the temperature of the coolant in the central channel being adjusted higher than a predetermined

temperature difference than that of the coolant in the circumferential channel;

supplying heat conductive gases to spaces between a rear surface of the specimen and a dielectric film comprising an upper surface of the specimen table, the spaces constituting independent spaces of a central space and an outer circumferential space by a ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside of the heat conductive block and contacts with the rear surface of the specimen, and adjusting a pressure of the heat conductive gas in the central space to be higher than that of the heat conductive gas in the outer circumferential space at a predetermined value of a pressure difference therebetween; and

after processing an upper film of the plurality of films on the specimen while maintaining the temperatures of the heat conductive block and the pressures of the heat conductive gases, changing the pressures of the heat conductive gases in the central space and the outer circumferential space, while the temperatures of the portions of the heat conductive block is maintained and processing a lower film of the plurality of films on the specimen.

Independent claim 45 recites various features that are somewhat similar to those recited in independent claim 39. For example, the specimen table comprises a central channel that is disposed in a central portion of a heat conductive block thereof, an outer circumferential channel in an outer circumferential portion of the heat conductive block, and a ring-like part disposed between the central channel and the outer circumferential channel inside the heat conductive block in order to suppress heat conduction between the central portion and the outer circumferential portion. Heat conductive gases are supplied to the spaces between the specimen rear surface and a dielectric film that comprises an upper surface of the specimen table. The spaces where the heat conductive gases are supplied are independent spaces that consist of a central space and an outer circumferential space by virtue of the ring-like protrusion which is disposed on the dielectric film at a position above the ring-like part inside the heat conductive block, and contacts the rear surface of the specimen. Further, the pressure of the heat conductive gas in the central space is

adjusted so that it is higher than that of the heat conductive gas in the outer circumferential space by a predetermined pressure difference. Additionally, after the upper film of the plurality of films on the specimen has been processed, the temperatures of the coolant and the pressures of the conductive gases are maintained. Subsequently, the value of the pressures of the heat conductive gases are changed in the central space and the outer circumferential space while the temperature of the coolant is maintained. The lower film of the plurality of films on the specimen is then processed.

As previously discussed, these features are not shown or suggested by the art of record.

It is therefore respectfully submitted that independent claim 45 is allowed over the art of record.

Claims 46-50 depend from independent claim 45, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 45. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

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AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 520.42565CX1).

Respectfully submitted,
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